

REMARKS

The present invention relates to a photosensitive polymeric network comprising an amorphous network and a photoreactive component.

Claims 1, 3-13, 18 and 21-28 are all the claims pending in the application. Claims 1, 3-13 and 21-28 were rejected; claim 8 was objected to, but Applicant appreciates that the Examiner has indicated that claim 8 would be allowable if rewritten in independent form. Claims 12, 13 and 18 stand withdrawn from consideration.

More particularly claim 1, 3-13 and 21-28 were rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 1, 3-5, 7, 9-11, 21 and 28 were rejected under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Langer et al (US 6,388,043B1). Lastly, claims 6 and 23-27 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Langer et al and Moro et al (US 2005/0118270A10).

In response, Applicant has hereinabove amended claim 1 to more clearly indicate the relationship between the amorphous network comprising the matrix component and the photoreactive crosslinking component, and further in this regard has incorporated claim 6 into claim 1; accordingly, claim 6 is canceled. Also, pursuant to the Examiner's indication that claim 8 would be allowable if placed independent form, claim 29 is added as an independent claim replacing claim dependent 8, which is accordingly canceled.

The polymeric network of the present invention is capable of being deformed without being heated due to its elastomeric properties. When it is irradiated with UV light while being deformed, the photoreactive component undergoes a reversible reaction forming additional

netpoints which fix a temporary shape. The transparency of the matrix towards UV light enables the light to permeate the material and to stimulate the photoreactive component also in deep layers. Thus, an extraordinary good fixation of the temporary shape is achieved. Moreover, the elastomeric properties of the matrix component allow the deformation of the material in order to program the temporary shape by room temperature. No application of heat is needed.

Prior art

The Examiner rejected claim 1 as being anticipated or obvious over Langer et al. Applicant respectfully disagrees. In fact, Langer et al. disclose amorphous, covalently crosslinked shape memory polymers (see for instance, col. 3, lines 31-36; col. 6, lines 54-59; col. 9, line 60 to col. 10, line 13) and also disclose photoreactive groups able to undergo a reversible crosslinking reaction upon stimulation with ultraviolet light (col. 4, lines 11-24; col. 11, lines 57-67). However, Langer et al. fail to disclose the combination of both. In the "Response to Arguments" section of the Office Action the Examiner refers to col. 9, line 60 to col. 10, line 13 and sets forth that Langer et al. disclose covalently crosslinking macromonomers containing polymerizable endgroups such as carbon-carbon double bonds by using ultraviolet sensitive initiators or photocrosslinkers. In fact, it is true that in this way an amorphous network is produced as required by present claim 1. However, this kind of crosslinking is not reversible; i.e. after photocrosslinking the macromonomers, the resulting network comprises not longer a photoreactive crosslinking component. Moreover, the production of photosensitive shape memory polymer networks by the application of ultraviolet light is not possible, because the disclosed photoreactive groups would irreversibly react with the acrylate monomers. For this reason, the synthesis of the claimed networks is completed by radical polymerisation rather than

by photochemical polymerization. The Examiner further refers to col. 10 (sic! it is understood that col. 11 was intended), lines 43-55. It is true that here a reversible photochemical stimuli is disclosed, but not in combination with covalently crosslinked networks. Thus, Langer et al. fails to disclose an amorphous network and a photoreactive crosslinking component able to undergo a reversible crosslinking reaction upon stimulation with ultraviolet light as required by present claim 1.

Langer et al. further fail to disclose that the matrix component is transparent for UV light and has elastomeric properties. In this connection, the Examiner set forth that these characteristics were inherent to the materials disclose by Langer et al., because Langer also discloses polyacrylate blocks (col. 7, lines 51-67; col. 8, lines 48-57). Again, it is admitted that Langer et al. disclose polyacrylate blocks as soft segments. However, these materials are not disclosed in connection with photoreactive groups or properties. This is apparent from col. 8, lines 44-45 and lines 52-57, where Langer et al. disclose that polymer blocks of methacrylic acid are crystalline and capable of melting and that acrylic acid units in contrast to methacrylic units, when dry, behave as a hard plastic even above the glass transition temperature and show no abrupt change in mechanical properties on heating (emphasis added). This clearly indicates that Langer et al. considered polymethacrylate blocks only in connection with heat stimuli rather than light stimuli. Nowhere does Langer et al. disclose that polymethacrylate are polyacrylate blocks are transparent for UV light or have elastomeric properties.

Moreover, Applicant wishes to emphasize that not every acrylate based polymer must necessarily be transparent for UV light. For instance, an SMP network of octadecylacrylate crosslinked with polyethyleneglycol methacrylate, although based on acrylates, is amorphous

rather than crystalline, and thus is opaque and not UV transparent (see publication Polymer, Volume 42, Issue 42, March 2001, pages 2531-2542).

Summarizing, Langer et al. disclose various kinds of polymer structures, various kinds of materials, as well as various kinds of stimuli, but fails to specifically disclose the combination of an amorphous network and a photoreactive crosslinking component. Even in Figure 5, showing the principle of a photoinduced shape memory effect, no covalent crosslinks other than those resulting from the reversible photoreactive crosslinking groups are disclosed. Figure 5 shows a thermoplastic polymer having an ABA block structure. Herein, the A blocks form domains which define the permanent shape by physical interactions (physical crosslinks). Block B is capable of reversibly photochemically crosslinking, thus to memorize a temporary shape.

The Examiner also rejected claims 6 and 23-27 relating to the use of acrylate and/or methacrylate materials for the matrix component as being obvious over Langer et al. in view of Moro et al. (US 2005/0118270 Al).

Applicant again respectfully disagrees. Moro et al. relates to gel particles and their production by polymerization of one or more monomers which may be selected from a group of acrylic and methacrylic monomers listed in par [0035]. The polymer can further be crosslinked by diacrylates or dimethacrylates disclosed in par [0041]. However, Moro et al. do not relate to shape memory materials. The hydrogels of Moro et al. trigger a drug release by their degree of swelling. The use of polyhydroxymethacrylate (HEMA) is intended to influence the swelling and the hydrophilic/hydrophobic ratio of controlling the drug release. No effect on the mechanical properties by HEMA is disclosed, nor the use of HEMA for the production of functionalized acrylate derivates. Furthermore, Moro et al. do not disclose the acrylic and

methacrylic monomers and the polymers produced thereof to be transparent for ultraviolet light or to have elastomeric properties. Thus, the skilled person would not receive any motivation from Moro et al. to apply the materials to the shape memory polymer of Langer et al. However, even if the skilled person would consider the materials of Moro et al. for the purposes of Langer et al., he would use them as heat sensitive switching blocks in heat sensitive shape memory polymers as disclosed in col. 8, lines 38-57 of Langer et al.

Thus, amended claim 1 is not obvious over the prior art.

With respect to the rejections under 35 U.S.C. § 112, Applicant respectfully submits that in view of the amendment of claim 1 above, that claim 1 and the claims dependent thereon are definite and in compliance with 35 U.S.C. § 112, second paragraph. Accordingly, the rejection under 35 U.S.C. § 112, second paragraph should now be withdrawn.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited.

If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



Joseph J. Ruch, Jr.
Registration No. 26,577

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE

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